

METHOD, SYSTEM, AND PROGRAM FOR TRANSMITTING
FACSIMILES IN A NETWORK ENVIRONMENT

Cross-Reference to Related Applications

5 This application is related to the following co-pending and commonly-
assigned patent applications, all of which are filed on the same date herewith, and all
of which are incorporated herein by reference in their entirety:

 "Method, System, And Program For Using Application Programs in Multiple
Computers to Render Attachments For a Fax Job," by Kevin W. Kirkeby,
10 having attorney docket no. ROC990252US1; and
 "Method, System, And Program For Transmitting Facsimiles in a Network
Environment Where Multiple Fax Servers Use a Common Rendering
Machine," by Kevin W. Kirkeby, having attorney docket no. ROC990250US1.

15 BACKGROUND OF THE INVENTION

1. Field of the Invention

 The present invention relates to a method, system, and program for managing
fax jobs in a network computing system and, in particular, processing messages that
include file attachments to transmit via facsimile to a recipient contact address, e.g., a
20 phone number, e-mail address, etc.

2. Description of the Related Art

 In network computing systems, users at client computers may send and receive
facsimiles through a shared system to centrally manage fax resources for network
25 users. One prior art implementation of a network facsimile system uses one or more
fax servers that are dedicated to receiving, rendering, transmitting, and otherwise
managing facsimile jobs from network users. The dedicated fax servers have modem
ports to directly transmit the fax message as well as perform all fax management

related operations. One disadvantage of using server class machines as the fax server is the substantial cost of server machines. Another disadvantage is that such fax servers would be limited to rendering fax documents created in server based applications. However, network users most likely create fax documents with
5 common application programs that are more likely to execute on personal computer oriented machines, such as word processors, graphics programs, spreadsheet programs, etc., that do not run efficiently or at all on the server machine. Thus, users could not use the fax server to transmit the type of documents they are most likely to have.

10 Another prior art network fax solution involves the use of a Windows NT server as a dedicated fax server that receives, renders, transmits and otherwise manages the facsimile message. The Windows NT fax server includes a modem port to transmit the facsimile as well as perform all fax management related operations. The disadvantage of this approach is that the network must incorporate a Windows
15 NT system and then install the server software on the Windows NT dedicated fax server to integrate with the overall system. This installation of the server software with the Windows NT is often undesirable from an integration and compatibility standpoint. Further, it is expensive to acquire Windows NT machines and the server licenses for fax server operations. Still further, the Windows NT system does not
20 optimally perform rendering and conversion operations because of the processor resources that must be used for fax transmission operations.

Thus, there is a need in the art for a more cost effective approach for managing the facsimile transmission of documents in a network environment that avoids incompatibility and integration problems with the current network architecture.

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SUMMARY OF THE PREFERRED EMBODIMENTS

To overcome the limitations in the prior art described above, preferred embodiments disclose a method, system, and program for processing a message in a

network computing system including a facsimile transmission comprised of a recipient contact address, such as a telephone number, e-mail address, network address, etc., and message content. The message content includes at least one of message text and attached files. A first computing system manages the facsimile transmission as a fax job and transfers the message content to a second computing system. The second computing system launches at least one application program to convert the message content to at least one image in a file format and transfers the converted message content in the file format to the first computing system. The first computing system, transfers the message content in the file format to a communication port for transmittal to the recipient contact address.

Preferred embodiments provide an improved technique for processing e-mail faxes with attachment files in a network environment by using a dedicated computer system to render and convert the attachment files to images in an image file format such as TIFF that are ready for facsimile transmission. With the preferred embodiments, the fax management operations are performed on a fax server and the file conversion operations are performed on a separate, dedicated conversion computer, such as a personal computer class machine that is particularly suited for rendering and converting attachment files to the image format. In this way, the fax server is freed of having to perform attachment file rendering and conversion operations which can consume substantial fax server resources. Instead, the rendering and conversion operations are performed by a different computing system, such as one or more personal computers, that are not only less expensive than the server class machines, but also are more efficient in rendering files in the personal computer application programs that are most typically used to create attachment files.

By using the dedicated conversion computer and freeing fax server resources from having to perform conversion operations, the fax server is capable of simultaneously managing more fax jobs and the dedicated conversion computer is capable of concurrently converting multiple attachment files from one or more fax

jobs. Thus, the throughput and processing capacity of the overall system is improved in a cost effective manner that is less expensive than the current solution of adding additional fax servers.

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BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings in which like reference numbers represent corresponding parts throughout:

FIG. 1 is a block diagram illustrating a computing environment in which preferred embodiments of the present invention are implemented; and

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FIG. 2 illustrates a workflow diagram of processing an e-mail to fax in accordance with preferred embodiments of the present invention.

FIG. 3 illustrates logic implemented in a fax server to process an e-mail fax in accordance with preferred embodiments of the present invention; and

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FIG. 4 illustrates logic implemented in a conversion computer to convert attachments to the e-mail fax to a TIFF file in accordance with preferred embodiments of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 In the following description, reference is made to the accompanying drawings which form a part hereof and which illustrate several embodiments of the present invention. It is understood that other embodiments may be utilized and structural and operational changes may be made without departing from the scope of the present invention.

25 FIG. 1 illustrates a computing environment in which preferred embodiments are implemented. Client computers 4a, b, c, include e-mail client programs 6a, b, c, such as the Lotus Notes network client software. The client computers 4a, b, c could assemble e-mail messages which would be initially routed to an e-mail server 8, which may comprise any network server known in the art including server software

for network messaging and routing e-mail messages from clients, such as the Lotus Domino server, Microsoft BackOffice Exchange Server, etc.** Those e-mails that are intended for facsimile transmission, referred to herein as "fax e-mails", are routed to a fax server 10 that includes fax management software 12. The fax server 10 is preferably a server class machine, such as the IBM AS/400. The fax server 10 includes one or more server class processors 14, memory 16, and server software (not shown), such as the Lotus Domino software. The processor 14 includes a central processing unit (CPU), which executes instructions to control the operations of the entire fax server 10. The memory 16 may comprise volatile memory and portions of non-volatile storage, where programs such as the fax management software 12 may be swapped between such volatile and non-volatile portions of memory 16. The fax server 10 fax management software 12 is capable of managing multiple facsimile transmissions transmitted for numerous network clients 4a, b, c. The fax server 10 would have access to one or more modem ports 18 capable of facsimile transmission.

15 The fax server 10 would transmit any attachments and message text in the fax e-mail message to a conversion computer 20. In preferred embodiments, the conversion computer 20 is a personal computer class machine having a personal computer class processor 22 and memory 24, which may comprise both volatile memory and non-volatile storage. Programs may be swapped between such volatile and non-volatile portions of memory 24. The processor 22 includes one or more central processing unit (CPU), which executes instructions to control the operations of the entire conversion computer 20. The conversion computer 20 further includes a fax conversion program 26. To convert attachments created using different software programs, e.g., word processors, spreadsheets, database, etc., the conversion computer 20 would include application programs 28a, b, c capable of opening and viewing the content of attachments from different application programs. The fax conversion program 26 would determine the application programs 28a, b, c needed to view

attachments in the fax e-mail and then launch those determined application programs 28a, b, c to convert the attachments to a common format, such as the TIFF file format.

In preferred embodiments, the fax server 10 is a server class machine, such as the AS/400, including a server class operating system, such as OS/400**, that is
5 capable of multitasking operations from numerous clients 4a, b, c in order to concurrently manage numerous facsimile transmissions for the clients. Because the conversion computer 20 is dedicated to converting fax e-mail attachments to images in a TIFF file format, the conversion computer 20 need not be as powerful, and hence expensive, as the fax server 10. However, the conversion computer 20 could be used
10 to perform non-fax related operations. Thus, in preferred embodiments, the conversion computer 20 comprises a personal computer with a personal computer operating system, such as Windows NT. However, alternative personal computer operating systems may be used, such as Windows 95/98/2000, IBM OS/2, Linux, etc.** Another benefit of using a personal computer system for the conversion
15 computer 20 is that not only are such systems less expensive than server class machines, but such systems are typically more suited for handling the fonts and graphics required for the conversion process than server machines. The personal computer and personal computer oriented operating systems are designed to handle the graphics requirements of common application programs 28a, b, c that will
20 typically be used to create the attachments to the fax e-mail that needs to be converted to a common file format (TIFF) for facsimile transmission.

In alternative embodiments, the conversion computer 20 may be implemented in an expansion card that is plugged into an expansion slot of the fax server 10, such as the IBM Integrated Netfinity Server.** The IBM Integrated Netfinity Server card
25 includes an Intel processor and PC memory, runs Windows NT and is capable of fitting into a PCI or SPD slot in the AS/400 server.

The different components of the network 4a, b, c, 8, 10, and 20 communicate over a network 24 comprised of any network technology known in the art.

FIG. 2 illustrates a workflow diagram of how a fax e-mail 30 is processed throughout the preferred embodiment fax processing system. The fax e-mail 30 includes a header 32 specifying a recipient, the sender, and a subject line, message text 34 which is the e-mail message and is preferably in a text format, such as the Rich Text Format (RTF), ASCII, etc., and one or more attachments 36, which may have been created with different application programs (e.g., word processor, spreadsheet program, graphics programs, database programs, etc.). The fax e-mail 30, including the header info 32 and message text 34, may alternatively include additional fields of information or less information than shown. To manage the flow of a fax e-mail 30, the fax management software 12 assigns the fax e-mail (fax job), a unique job number, which is used to uniquely identify the fax job as it proceeds through the workflow.

The fax management software 12 maintains a job table 40, which is used to control the workflow of the fax e-mail job. The job table 40 may comprise a database table or any other data structure known in the art. Still further, the table 40 may include more, less or different fields than shown in FIG. 2. The job table 40 includes as a key column the unique job number field 42 of the job; a job state field 44 indicating the current state of the job in the fax workflow; a message field 46 including all the components 32, 34, 36 of the e-mail message 30; and a rendered fax TIFF field 48 including TIFFs files rendered at the conversion computer 20. Thus, the job table 40 provides the core information needed to control the fax workflow. Alternatively, certain of the fields in the job table 40 may be maintained at alternative locations. For instance, the e-mail message field 46 and rendered fax TIFF field 48 may include pointers to storage or memory locations where the actual data, i.e., components 32, 34, and 36 of the e-mail message 30 and rendered TIFF files 50 and 52, respectively, are maintained, instead of the actual files and data.

The job table may include the following states:

New state: the state when the job number is first generated and a fax job entry is created in the job table 40.

5 Converting state: the state after the job number of a fax job record having the new state is sent to the conversion computer.

Delivery state: the state after the fax management software 12 receives from the conversion computer 20 message text 34, attachment files 36, and any cover page converted into one or more TIFF files.

10 Transmitting state: the state after the fax management software 12 sends the rendered TIFF files to the modem port 18.

Transmission Status states: these are states following the modem port's 18 transmission, and may indicate completed, retrying, failure, etc.

In alternative embodiments, fewer or more states may be used for the workflow or different naming conventions may be used for the states.

15 In preferred embodiments, the conversion computer 20 receives the job number and then accesses the job table 40 to obtain the header 32, message text 34 and any attachment files 36 to render into a message content TIFF 50. Using the header info 32, the fax conversion program 26 would access, if available, a separate cover page form for the sender from a cover page database, typically maintained at a
20 server (not shown) elsewhere in the network 24. If there is no cover page for the sender in the cover page database or the sender has not requested the use of a cover page, then the fax would be rendered without a cover page. If a cover page form is provided, the conversion program 26 would render the accessed cover page into a cover page TIFF 52. The conversion computer 20 would send the rendered message
25 content TIFF 50 and a cover page TIFF 52 to the fax server 10. The fax management software 12 would insert the rendered TIFF files 50 and 52 in the rendered fax TIFF field 48 to await the transmission mode.

In preferred embodiments, the message content TIFF 50 includes a first page that includes the e-mail window view, including all the header info 32, message text 34, and graphical representations (e.g., icons) of attachments 36 as is commonly displayed in an e-mail message. Following the e-mail view would be the renderings of any attachments 36.

In preferred embodiments, a separate task or thread is spawned in the conversion computer 20 to process each fax job received from the fax server 10. In this way, the conversion computer 20 may concurrently process each received fax number in separate job number tasks 54a, b, c, as shown in FIG. 2, wherein the components of each job are sequentially processed in each task.

In preferred embodiments, the tasks 54a, b, c execute as separate threads under control of the fax conversion program 26. In this way, the fax job conversion operations are multi-tasked across fax jobs. Still further, multiple threads may be spawned under the fax conversion program 26 to concurrently render different attachments in the same fax job.

FIG. 3 illustrates logic implemented in the fax management software 12 to process the workflow of e-mail fax jobs from multiple clients 4a, b, c. At block 100, the fax management software 12 receives a fax e-mail message 30 from one of the clients 4a, b, c via e-mail server 8. The fax management software 12 would then generate (at block 102) a unique job number for the e-mail fax job and create (at block 104) a new record in the job table 40 to include the generated unique number in the job number field 42 and the components 32, 34, and 36 of the received fax e-mail message 30 in the e-mail message field 46. The job state 44 for the new record is set to "New."

At block 106, the fax management software 12 would access records in the job table 40 having the "New" state, send (at block 108) the job number for the accessed records to the conversion computer 20, and set the state to "Converting".

At block 110, the fax management software 12 receives TIFF files for a job number from the conversion computer 20 and then inserts (at block 112) the rendered TIFF file(s), which would include the message content TIFF 50 and, if available, the cover page TIFF 52, into the rendered fax TIFF field 48 of the record for the job number. The state for these updated records is set to "Delivery". As discussed, if there is no cover page or none is requested, then the fax job would only include the message content TIFF 50.

At block 114, the fax management software 12 accesses records in the job table 40 having the "Delivery" state and sends (at block 116) the TIFF files 50, 52 in the rendered fax TIFF field 48 to the modem port 18 and changes the state for such records to "Transmitting".

At block 118, the fax management software 12 receives a status message from the modem port 18 for a fax job number. The fax management software 12 then updates (at block 120) the state to a possible transmission state, e.g., completed, failed, retrying, etc., and then sends (at block 122) a message to the sender over the network 24 indicating the status of the transmission.

The operations beginning at blocks 100, 106, 110, 114, and 118 may be executed concurrently as separate tasks and operate asynchronously. Because, in preferred embodiments, the fax management software 12 is running in a server class machine, it is capable of multitasking. The operations beginning at: block 110 is triggered in response to a message from the conversion computer 20; block 100 is triggered when the fax management software 12 receives a fax e-mail from the e-mail server 8; and block 118 is triggered in response to a message from the modem port 18. In preferred embodiments, the fax management software 12 may initiate the operations beginning at blocks 106 and 114 at periodic intervals or in response to the state being set to "New" (for block 106) and the state being set to "Delivery" (for block 114). However, alternative techniques may be used to trigger the operations described above and process the records in the job table 40.

FIG. 4 illustrates logic implemented in the fax conversion program 26 to convert attachments for a fax job into TIFF files 50 and 52. Control begins at block 150 with the fax conversion program 26 receiving a job number from the fax server 10. In preferred embodiments, because the conversion computer 20 is dedicated to fax conversion operations, the fax conversion program 26 may concurrently convert attachments for multiple fax jobs executed in tasks 54a, b, c. The fax conversion program 26 then queries (at block 152) the job table 40 for the record having a job number field value matching the job number and then accesses the components 32, 34, and 36 in the e-mail message field 46 of the accessed record. The fax conversion program 26 then converts (at block 154) the header 32, message text 34, which is in a text format (e.g., ASCII, RTF, etc.), and graphical representations of the attachments 36 into a TIFF image and embeds the image into the message content TIFF file 50.

The fax conversion program 26 then begins a loop at block 156 through 170 to convert each attachment 36 to a TIFF image. The fax conversion program 26 may process a directory or table associating application programs with file types to determine (at block 158) whether there is an installed application program 28a, b, c capable of opening and transforming the attached file. If there is no available application program, then an error message is generated (at block 160), which may cause the facsimile job to fail. Otherwise, if there is an available application program 28a, b, c, the application program 28a, b, c is launched (at block 164) if it is not already open (at block 162). The attached file is then opened (at block 166) in the application program 28a, b, c. The fax conversion program 26 then converts (at block 168) the opened file into one or more TIFF images which are then embedded into the message content TIFF file 50 and linked to any previous image in a manner known in the art.

To generate a cover page, the fax conversion program 26 queries (at block 172) a cover page database table (not shown) to determine if there is a cover page record for the sender. If so (at block 174), the fax conversion program 26 accesses (at

block 176) the template for the cover page from the user record in the cover page table and builds (at block 178) a cover page from the accessed template and header info 32. From block 178, the fax conversion program 26 then sends the message content 50 and cover page 52 TIFF files to the fax server 10 with the unique job number to complete the fax job. Otherwise, if there is no cover page to generate for the fax job (from the no branch at block 174), the fax conversion program 26 sends only the message content TIFF file 50 to the fax server 10.

In further embodiments, the fax conversion program 26 may include logic to manage the number of application programs 28a, b, c open at any given time to conserve system resources. For instance, a timer may be used. In such case, if an application program remains open for a certain period of time without being used to open and convert an attachment file, then the fax conversion program 26 may close the application program 28a, b, c to conserve system resources. However, those application programs 28a, b, c that are more frequently used will remain open to avoid having to continually close and open an application program 28a, b, c, which also consumes substantial system resources.

Still further, to optimize conversion processing time, the fax conversion program 26 may use a single application program 28a, b, c to concurrently convert multiple attachment files associated with the application program 28a, b, c to TIFF images. If the application program 28a, b, c allows for multi-threading or tasking, then a single instance of the application program 28a, b, c can concurrently convert multiple attachment files to TIFF images. Otherwise, multiple instances of the application program 28a, b, c may be opened to concurrently convert multiple attachment files to TIFF images. Yet further, because the conversion computer 20 is dedicated to rendering and conversion operations, it may concurrently process attachment files from different fax jobs to concurrently convert the attachment files from different fax jobs to TIFF images. Thus, with the preferred embodiment architecture, the fax server 10 may concurrently process fax jobs and the conversion

computer 20 may concurrently convert attachment files to TIFF images so all aspects of different fax jobs are processed in parallel.

The preferred embodiment network facsimile architecture and workflow provides improvements over prior art network fax server technologies because the fax server 10 is relieved of performing the rendering and conversion operations, which in prior art systems requires substantial fax server resources, thus requiring additional fax server machines to maintain system performance. With the preferred embodiments, the rendering and conversion process is transferred to a dedicated personal computer class system that is especially suited for handling the conversion operations, such as a personal computer including a personal computer operating system and graphics engine, such as a graphics card. Most attachments are typically created using personal computer application programs, such as word processors, graphics programs, spreadsheets, etc., that are graphics intensive. A dedicated personal computer class system can more efficiently and effectively handle the conversion operations than a server class machine because typically the application programs used to create the attachments are designed to run on a personal computer machine including a graphics card and PC operating system, e.g., Microsoft Windows 98, NT, IBM O/S2, etc.

The preferred architecture is also advantageous because a personal computer class machine is typically substantially less expensive than a server class machine such as the IBM AS/400. The use of a dedicated personal computer class machine in the fax workflow environment reduces processing burdens on the fax server by transferring the conversion and rendering operations to one or more dedicated personal computer machines which are both less expensive and more suited for rendering and conversion operations than the fax server. By conserving fax server computing resources, fewer fax servers are needed in the network as the fax servers may now focus exclusively on fax job management operations, which is what server class machines are most suited for – managing multiple jobs in a workflow

environment. Thus, fax server resources are relieved from performing rendering and conversion operations with less expensive personal computing resources that can perform the rendering and conversion operations more efficiently than the fax server.

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Conclusion

This concludes the description of the preferred embodiments of the invention. The following describes some alternative embodiments for accomplishing the present invention.

The preferred embodiments may be implemented as a method, apparatus or
10 signal bearing media using standard programming and/or engineering techniques to produce software, firmware, hardware, or any combination thereof. The programs defining the functions of the preferred embodiment can be delivered to a computer via a variety of signal-bearing media, which include, but are not limited to, computer-readable devices, carriers, or media, such as a magnetic storage media, "floppy disk,"
15 CD-ROM, a file server providing access to the programs via a network transmission line, wireless transmission media, signals propagating through space, radio waves, infrared signals, etc. Of course, those skilled in the art will recognize that many modifications may be made to this configuration without departing from the scope of the present invention. Such signal-bearing media, when carrying computer-readable
20 instructions that direct the functions of the present invention, represent alternative embodiments of the present invention.

Preferred embodiments described certain of the tables and fax processing operations performed in the fax server 10 and the conversion computer 20. However, certain of the operations described as performed with respect to the fax server 10 may
25 be performed in the conversion computer 20 and vice versa.

In preferred embodiments, the e-mail server 8 was described as implemented in a separate machine from the fax server 10. In alternative embodiments, the e-mail, fax and other server related management and routing operations may be performed in

a single server machine or across multiple server machines, depending on the processing needs of the network.

In preferred embodiments, the message from the client including the fax job was transmitted as an e-mail message. However, in alternative embodiments,
5 alternative network messaging formats may be used to communicate fax jobs from the clients to the fax server.

In preferred embodiments, the cover page and attachments were converted to images in the TIFF file image format. However, in alternative embodiments, the cover page, message and/or attachments may be converted to an image in a different
10 file format than TIFF that is compatible with the facsimile image transmissions capabilities. Moreover, all images in the fax job may be embedded in a single TIFF file or dispersed throughout any number of TIFF files.

In summary, preferred embodiments disclose a system, method, and program for processing a message in a network computing system including a facsimile
15 transmission comprised of a recipient contact address, such as a telephone number, e-mail address, network address, etc., and message content. The message content includes at least one of message text and attached files. A first computing system manages the facsimile transmission as a fax job and transfers the message content to a second computing system. The second computing system launches at least one
20 application program to convert the message content to at least one image in a file format and transfers the converted message content in the file format to the first computing system. The first computing system, transfers the message content in the file format to a communication port for transmittal to the recipient contact address.

The foregoing description of the preferred embodiments of the invention has
25 been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Many modifications and variations are possible in light of the above teaching. It is intended that the scope of the invention be limited not by this detailed description, but rather by

5 appended.

Figure 1 consists of 12 histograms arranged horizontally, labeled x_1 through x_{12} . Each histogram shows the frequency of values for x_k ranging from 0 to 10. The y-axis for each histogram is labeled 'count' and ranges from 0 to 10. The distributions are roughly bell-shaped and centered around 5. The peak count increases from 10 for x_1 to 10 for x_{12} .